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Modelled outdoor temperature effects and heat-related mortality impact of cool roofs and rooftop photovoltaics in London

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Population exposure to high temperatures poses health risks and increases mortality, but comprehensive studies comparing impacts of building and street level interventions on air temperature at urban scales are still lacking. High-albedo roofs (also called “cool roofs”) can lower the air temperature in urban areas, compared to standard low-albedo roofs. As part of the transition to renewable power generation rooftop regional authorities in the UK have set targets for rooftop solar panel capacity, but some recent studies have argued that solar panels may increase urban temperatures and therefore have unintended consequences. Using advanced urban climate modelling (WRF BEP-BEM), we model the impact of these cool roofs and rooftop photovoltaics on urban air temperature during the record-breaking hot summer of 2018, and estimate the impact these measures may have on heat-related mortality.

We find that cool roofs and rooftop photovoltaics both decrease modelled daily-mean temperature compared to standard low-albedo roofs. Rooftop photovoltaics may reduce heat-related mortality by 96 (12%), or cool roofs by 249 (33%), in scenarios where all roofs have these measures. Monetised using value of statistical life, we estimate benefits for solar roofs and cool roofs of £237M and £616M respectively for London July-August 2018 conditions, and we estimate 20 TWh of electricity, worth £3-6 billion, would be generated in the rooftop PV scenario. Our modelling indicates that, in the conditions of London July-August 2018, rooftop PV or cool roofs may reduce near-surface air temperatures and therefore heat related mortality, with cool roofs having a larger effect.